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QUERY CONTROL FORM		RTIS USE ONLY	
Application No. <u>09/885,609</u>	Prepared by <u>NPB</u>	Tracking Number <u>05883815</u>	
Examiner-GAU <u>NELMS-288</u>	Date <u>2/26/04</u>	Week Date <u>1/5/04</u>	
	No. of queries <u>2</u>	IPW	

JACKET			
a. Serial No.	f. Foreign Priority	k. Print Claim(s)	p. PTO-1449
b. Applicant(s)	g. Disclaimer	l. Print Fig.	q. PTOL-85b
c. Continuing Data	h. Microfiche Appendix	m. Searched Column	r. Abstract
d. PCT	i. Title	n. PTO-270/328	s. Sheets/Figs
e. Domestic Priority	j. Claims Allowed	o. PTO-892	t. Other

SPECIFICATION	MESSAGE
a. Page Missing	<p>① pto-1449 firms (10 pages): please either initial or line through citations. (copy provided for reference).</p> <p>② there are two(2) claim 28's in the text. please advise/renumber the claims in the index of claims and text, if necessary.</p> <p><i>Thompson</i></p>
b. Text Continuity	
c. Holes through Data	
d. Other Missing Text	
e. Illegible Text	
f. Duplicate Text	
g. Brief Description	
h. Sequence Listing	
i. Appendix	
j. Amendments	
k. Other	
<p>initials <i>AMB</i></p>	
CLAIMS	RESPONSE <u>1449 initialed</u>
a. Claim(s) Missing	<p>The claims were cancelled by applicant on 2/26/04 see Preliminary Amendment</p>
b. Improper Dependency	
c. Duplicate Numbers	
d. Incorrect Numbering	
e. Index Disagrees	
f. Punctuation	
g. Amendments	
h. Bracketing	
i. Missing Text	
j. Duplicate Text	
k. Other	initials <i>AMB</i>

U.S. Department of Commerce, Patent and Trademark Office (PTO Form 1449 modified)		Docket No. AMAT/5351/CPI/LB/ PJS	Serial No. 09/885,609
SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT		Applicant Mak, et al.	Confirmation No.: 5337
(Use several sheets if necessary)		Filing Date June 20, 2001	Group 2818
Examiner Renee R. Berry			

## U.S. Patent Documents

*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate
MB	A1	6,139,700	10-31-2000	Kang, et al.	204	192.17	09-30-1998
	A2						
	A3						
	A4						
	A5						
	A6						
	A7						
	A8						
	A9						
	A10						
	A11						
	A12						
	A13						

## Foreign Patent Documents

*Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
	B1						<input type="checkbox"/>	<input type="checkbox"/>
	B2						<input type="checkbox"/>	<input type="checkbox"/>
	B3						<input type="checkbox"/>	<input type="checkbox"/>

## OTHER ART

*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.
MB	C1	PCT International Search Report from International Application No. PCT/US02/19481, Dated 08 January 2003.
	C2	
	C3	

Examiner MB Date Considered 4-9-04

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*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate
MB	A1	6,481,945	11-19-2002	Hasper, et al.	414	217	06-04-1999
MB	A2	6,478,872	11-12-2002	Chae, et al.	117	88	12-20-1999
MB	A3	6,447,607	09-10-2002	Soininen, et al.	117	200	12-27-2000
MB	A4	6,231,672	05-15-2001	Choi, et al.	118	715	05-18-1999
MB	A5	6,183,563	02-06-2001	Choi, et al.	118	715	05-18-1999
MB	A6	2002/0134307	09-26-2002	Choi	118	715	11-30-2000
MB	A7	2002/0108570	08-15-2002	Lindfors	118	715	04-16-2001
MB	A8	2002/0094689	07-18-2002	Park	438	694	03-07-2002
MB	A9	2002/0092471	07-18-2002	Kang, et al.	118	715	01-16-2002
MB	A10	2002/0086106	07-04-2002	Park, et al.	427	248.1	11-07-2001
MB	A11	2002/0041931	04-11-2002	Suntola, et al.	427	255.28	05-14-2001
MB	A12	2002/0007790	01-24-2002	Park	118	715	05-03-2001
MB	A13	2002/0000196	01-03-2002	Park	118	715	05-03-2001

## Foreign Patent Documents

*Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
MB	B1	EP 1 167 569 ✓	01-02-2002	EP	C23C	16/455		X
MB	B2	WO 02/08488 ✓	01-31-2002	WIPO	C23C	16/44		X
MB	B3	WO 01/17692 ✓	03-15-2001	WIPO	B05C	11/00		X
MB	B4	WO 99/65064 ✓	12-16-1999	WIPO	H01L	21/00		X

## OTHER ART

*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.
	C1	
	C2	

Examiner

YMB

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4-9-00

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MB	A14	2002/0052097	Park	438	507	05-03-2001
MB	A15	2001/0054377	Lindfors, et al.	117	104	04-16-2001
MB	A16	2001/0042523	Kesala	122	6.6	05-14-2001
MB	A17	2001/0014371	Kilpi	427	255.28	12-27-2000
MB	A18	2001/0013312	Soininen, et al.	117	86	12-27-2000
MB	A19	2001/0009140	Bondestam, et al.	118	725	01-25-2001
	A20					
	A21					
	A22					
	A23					
	A24					
	A25					
	A26					

## Foreign Patent Documents

*Examiner Initial	Document Number	Date	Country	Class	Subclass	Translation	
						YES	NO
	B5						
	B6						
	B7						

## OTHER ART

*Examiner Initial	Including Author, Title, Date, Pertinent Pages, Etc.
	C3
	C4
	C5

Examiner *MB*Date Considered *4-4-02*

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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(use as many sheets as necessary)*

Sheet

1

of

2

Application Number

**09/885.609**

**Filing Date**

06/20/2001

**First Named Inventor**

Mak et al.

### Group Art Unit

2812

Examiner Name \_\_\_\_\_

unassigned

Attorney Docket Number

5351/AMI-00-12

## U.S. PATENT DOCUMENTS

[illegible]

**FOREIGN PATENT DOCUMENTS**

[illegible]

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Signature**

18/12/2017

Date  
Considered

4-4-21

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JAN 24 2002

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Sheet	2	of	2
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<b>Application Number</b>	09/885,609
<b>Filing Date</b>	06/20/2001
<b>First Named Inventor</b>	Mak et al.
<b>Group Art Unit</b>	2812
<b>Examiner Name</b>	unassigned
<b>Attorney Docket Number</b>	5351/AMI-00-12

[illegible]

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Considered

4-4-00

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<sup>1</sup>Unique citation designation number <sup>2</sup>Applicant is to place a check mark here if English language Translation is attached

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Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet	1	of	4
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**Complete if Known**

<b>Application Number</b>	09/885,609
<b>Filing Date</b>	06/20/2001
<b>First Named Inventor</b>	Mak et al.
<b>Group Art Unit</b>	2812
<b>Examiner Name</b>	Unassigned
<b>Attorney Docket Number</b>	5351/AMI-00-12

## U.S. PATENT DOCUMENTS

Examiner Initials*	Cite: No.	U.S. Patent Document		Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-Y.YYY	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number	Kind Code* (if known)			
RAJ	AI	4,058,430		Suntola et al.	11-15-1977	—
RAJ	AJ	4,389,973		Suntola et al.	06-28-1983	—
RAJ	AK	4,413,022		Suntola et al.	11-01-1983	—
RAJ	AL	4,767,494		Kobayashi et al.	08-30-1988	—
RAJ	AM	4,806,321		Nishizawa et al.	02-21-1989	—
RAJ	AN	4,840,921		Matsumoto	06-20-1989	—
RAJ	AO	4,845,049		Sunakawa	07-04-1989	—
RAJ	AP	4,859,627		Sunakawa	08-22-1989	—
RAJ	AQ	4,861,417		Mochizuki et al.	08-29-1989	—
RAJ	AR	4,876,218		Pessa et al.	10-24-1989	—
RAJ	AS	4,993,357		Scholz	02-19-1991	—
RAJ	AT	5,082,798		Arimoto	01-21-1992	—
RAJ	AU	5,130,269		Kitahara et al.	07-13-1992	—
RAJ	AV	5,166,092		Mochizuki et al.	11-24-1992	—
RAJ	AW	5,225,366		Yoder	07-06-1993	—
RAJ	AX	5,250,148		Nishizawa et al.	10-05-1993	—
RAJ	AY	5,256,244		Ackerman	10-26-1993	—
RAJ	AZ	5,270,247		Sakuma et al.	12-14-1993	—
RAJ	BA	5,278,435		Van Hove et al.	01-11-1994	—
RAJ	BB	5,281,274		Yoder	01-25-1994	—

## FOREIGN PATENT DOCUMENTS

[illegible]

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Signature**

1861

Date  
Considered

4-7-04

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<b>Application Number</b>	09/885,609
<b>Filing Date</b>	06/20/2001
<b>First Named Inventor</b>	Alfred W. Mak
<b>Group Art Unit</b>	2812
<b>Examiner Name</b>	Unassigned
<b>Attorney Docket Number</b>	5351/AMI-00-12

*(use as many sheets as necessary)*

Sheet	2	of	4
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Examiner Initials	Cite No. <sup>1</sup>	U.S. Patent Document		Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number	Kind Code <sup>2</sup> (if known)			
MP	BC	5,290,748		Knuutila et al.	03-01-1994	1
MP	BD	5,294,285		Nishizawa et al.	03-15-1994	1
MP	BE	5,300,185		Kitahara et al.	04-05-1994	1
MP	BF	5,315,793		Wallace et al.	05-31-1994	1
MP	BG	5,330,610		Eres et al.	07-19-1994	1
MP	BH	5,335,324		Stall et al.	08-09-1994	1
MP	BI	5,338,389		Nishizawa et al.	08-16-1994	1
MP	BJ	5,374,570		Nasu et al.	12-20-1994	1
MP	BK	5,395,791		Cheng et al.	03-07-1995	1
MP	BL	5,443,033		Nishizawa et al.	08-22-1995	1
MP	BM	5,443,647		Aucoin et al.	08-22-1995	1
MP	BN	5,458,084		Thorne et al.	10-17-1995	1
MP	BO	5,480,818		Matsumoto et al.	01-02-1996	1
MP	BP	5,484,664		Kitihara et al.	01-16-1996	1
MP	BO	5,483,919		Yokoyama et al.	01-16-1996	1
MP	BR	5,532,511		Nishizawa et al.	07-02-1996	1
MP	BS	5,637,530		Gaines et al.	06-10-1997	1
MP	BT	5,693,139		Nishizawa et al.	12-02-1997	1
MP	BU	5,705,224		Murota et al.	01-06-1998	1
MP	BV	5,711,811		Suntola et al.	01-27-1998	1

[illegible]

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Sheet	3	of	4
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<b>First Named Inventor</b>	Alfred W. Mak
<b>Group Art Unit</b>	2812
<b>Examiner Name</b>	Unassigned
<b>Attorney Docket Number</b>	5351/AMI-00-12

[illegible][illegible]

Examiner Signature	<i>R. H. DeWitt</i>
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Date Considered	4-9-04
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**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**

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Sheet

4

of

4

Attorney Docket Number

5351/AMI-00-12

## OTHER PRIOR ART - NON PATENT LITERATURE DOCUMENTS

[illegible]

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NRBey

Date  
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4-4-6 ✓

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11046 U.S. PTO  
09/885609  
06/20/01

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Examiner Signature	<i>[Signature]</i>	Date Considered	<i>4-9-68</i>
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sequentially repeating the exposure to the first and second reactive gases until an adhesion layer having a desired thickness is formed;  
exposing the substrate surface to a third reactive gas;  
exposing the substrate surface to a fourth reactive gas; and then  
sequentially repeating the exposure to the third and fourth reactive gases until a barrier layer having a desired thickness is formed over the adhesion layer.

27. (Original) The method of claim 26, wherein the first reactive gas comprises a refractory metal-containing compound.

→ 28. (Original) The method of claim 27, wherein the refractory metal-containing compound comprises TDMAT, TDEAT,  $\text{TiCl}_4$ , or combinations thereof.

\* changed to 24

→ [[28]] 29. (Currently Amended) The method of claim 27, wherein the second precursor gas comprises a reducing compound.

[[29]] 30. (Currently Amended) The method of claim [[28]] 29, wherein the reducing compound comprises  $\text{H}_2$ ,  $\text{B}_2\text{H}_6$ ,  $\text{SiH}_4$ ,  $\text{NH}_3$ , or combinations thereof.

[[30]] 31. (Currently Amended) The method of claim 27, wherein the third precursor gas comprises a refractory metal-containing compound.

[[31]] 32. (Currently Amended) The method of claim [[30]] 31, wherein the refractory metal-containing compound comprises tungsten.

[[32]] 33. (Currently Amended) The method of claim 27, wherein the fourth comprises a reducing compound.

[[33]] 34. (Currently Amended) The method of claim [[32]] 33, wherein the reducing compound comprises  $\text{SiH}_4$ ,  $\text{B}_2\text{H}_6$ ,  $\text{NH}_3$ , or combinations thereof.

[[34]] 35. (Currently Amended) The method of claim 26, further comprising depositing copper at least partially over the barrier layer.

[[35]] 36. (Currently Amended) The method of claim 26, wherein the adhesion layer is deposited within a first processing chamber.

[[36]] 37. (Currently Amended) The method of claim [[35]] 36, wherein the barrier layer is deposited within a second processing chamber.

[[37]] 38. (Currently Amended) The method of claim [[36]] 37, wherein the copper is deposited in a third processing chamber.

[[38]] 39. (Currently Amended) The method of claim [[37]] 38, wherein the first, second and third processing chambers are each disposed about a common mainframe.

[[39]] 40. (Currently Amended) The method of claim [[35]] 36, wherein the adhesion layer and the barrier layer are both deposited in the first chamber.

[[40]] 41. (Currently Amended) A method for depositing a barrier layer on a substrate surface, comprising:

sequentially exposing the substrate surface to a first refractory metal-containing compound and a first reducing compound; and

sequentially exposing the substrate surface to a second refractory metal-containing compound and a second reducing compound to form the barrier layer.

[[41]] 42. (Currently Amended) The method of claim [[40]] 41, wherein the first refractory metal-containing compound comprises TDMAT, TDEAT,  $\text{TiCl}_4$ , or combinations thereof.

[[42]] 43. (Currently Amended) The method of claim [[40]] 41, wherein the second refractory metal-containing compound comprises tungsten.

[[43]] 44. (Currently Amended) The method of claim [[40]] 41, wherein the first and second reducing compounds is selected from a group consisting of  $\text{SiH}_4$ ,  $\text{B}_2\text{H}_6$ ,  $\text{NH}_3$ , and combinations thereof.

[[44]] 45. (Currently Amended) The method of claim [[40]] 41, wherein the barrier layer comprises titanium, titanium nitride, tungsten, tungsten nitride, or combinations thereof.

[[45]] 46. (Currently Amended) The method of claim [[40]] 41, wherein the adhesion layer is deposited within a first processing chamber and the barrier layer is deposited within a second processing chamber.

[[46]] 47. (Currently Amended) The method of claim [[40]] 41, further comprising depositing copper at least partially over the barrier layer.

[[47]] 48. (Currently Amended) The method of claim [[46]] 47, wherein the adhesion layer is deposited within a first processing chamber and the barrier layer is deposited within a second processing chamber.

[[48]] 49. (Currently Amended) The method of claim [[47]] 48, wherein the copper is deposited in a third processing chamber and the first, second and third processing chambers are each disposed about a common mainframe.

[[49]] 50. (Currently Amended) The method of claim [[47]] 48, wherein the adhesion layer and the barrier layer are both deposited in the first chamber.

[[50]] 51. (Currently Amended) A method for forming a metal contact on a substrate surface, comprising:

sequentially exposing the substrate surface to a titanium-containing compound and a nitrogen-containing compound to form an adhesion layer comprising titanium nitride;

sequentially exposing the substrate surface to a tungsten-containing compound and a reducing compound to form a barrier layer comprising tungsten; and

depositing copper at least partially over the barrier layer to form the metal contact.

[[51]] 52. (Currently Amended) The method of claim [[50]] 51, wherein the tungsten-containing compound comprises TDMAT, TDEAT,  $\text{TiCl}_4$ , or combinations thereof.

[[52]] 53. (Currently Amended) The method of claim [[50]] 51, wherein the reducing compound is selected from a group consisting of  $\text{SiH}_4$ ,  $\text{B}_2\text{H}_6$ ,  $\text{NH}_3$ , and combinations thereof.

[[53]] 54. (Currently Amended) The method of claim [[50]] 51, wherein the adhesion layer is deposited within a first processing chamber and the barrier layer is deposited within a second processing chamber.

[[54]] 55. (Currently Amended) The method of claim [[53]] 54, wherein the copper is deposited in a third processing chamber and the first, second and third processing chambers are each disposed about a common mainframe.